research

PERFORMANCE ANXIETY

Psychologist Sian Beilock studies what makes people choke under pressure and offers techniques to prevent those mental meltdowns.

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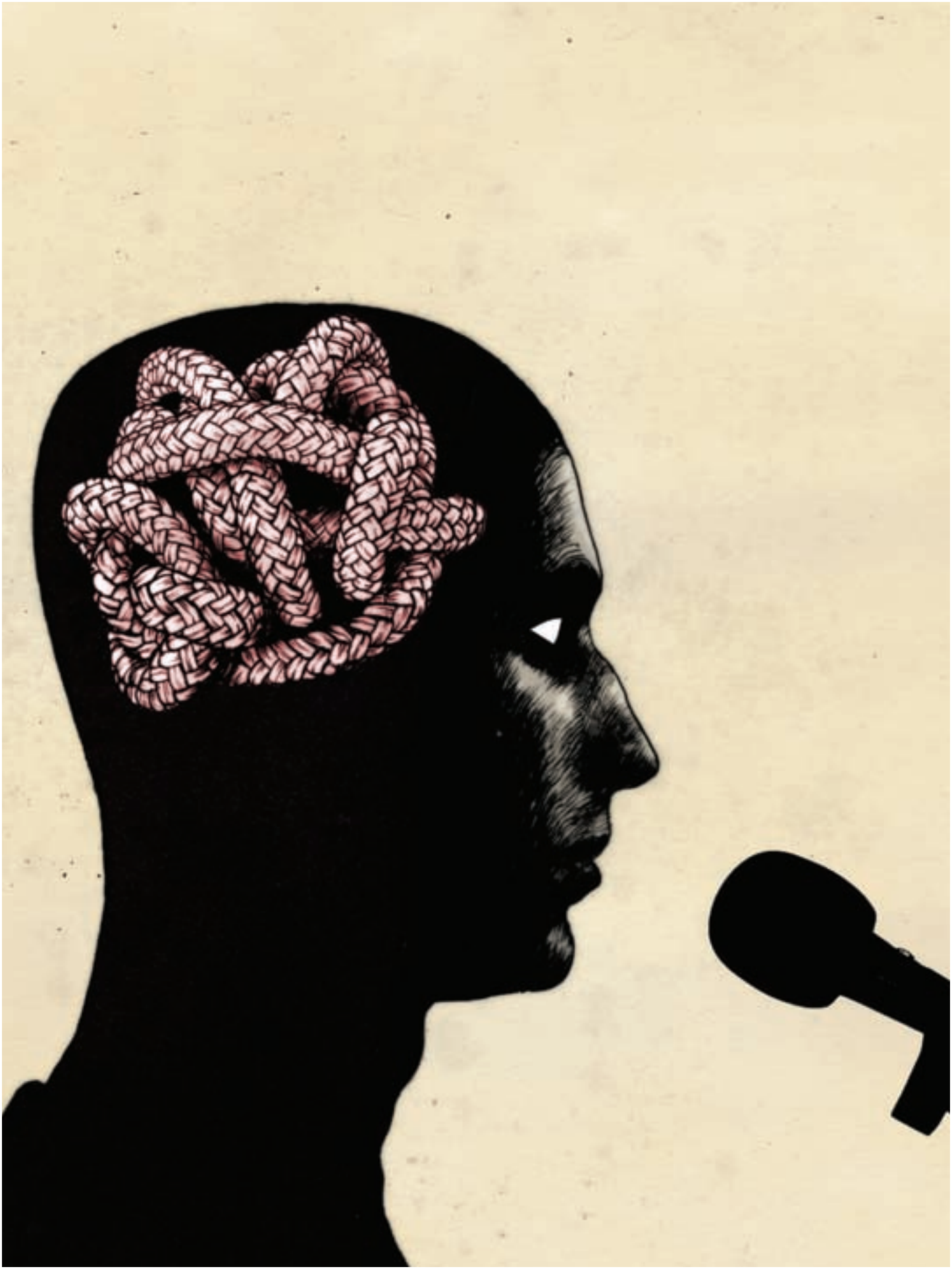

The true fielder lets the path of the ball become his own path, thereby comprehending the ball and dissipating the self, which is the source of all suffering and poor defense.—Aparicio Rodriguez, *The Art of Fielding*

I was a 12-year-old all-star, a designation I coveted and dreaded. In the summer of 1985, East Side Little League had a lot of talent, so to be selected as one of the 15 or 20 best players meant a lot. But a spot on that roster also came with pressure. There were high expectations.

Our team played in the annual international baseball tournament that begins at the local level and culminates in the Little League World Series. Nobody thought we'd get that far, but a state title was a real possibility. That year the state finals happened to be in our hometown, a disappointment for kids who could imagine no greater reward for reaching the finals than a couple of nights in a hotel. Playing at home didn't just take some of the fun out of the experience; it also might have hurt our chances to win.

Sian Beilock, associate professor of psychology, explores the ways our minds betray us in high-stakes situations, including the detrimental effect of an encouraging crowd. "The more supportive and friendly that audience is," Beilock writes, "the more self-aware we as performers get." Her book, *Choke: What the Secrets of the Brain Reveal About Getting It Right When You Have To* (Free Press, 2010), illustrates how self-awareness can make even the most fluid athlete's joints creak like the Tin Man.

Certain types of physical expertise—fielding a ground ball, playing the violin—are best performed outside our conscious awareness. For people who do them well, those actions become part of their "procedural memory," the implicit, complex motor skills that can be difficult to articulate. How do you ride a bike?

Pressure compromises procedural memory. Under stress, many people think about the mechanics of their actions to control the situation, but that conscious thought actually diminishes their expertise. "Don't think, just do," choreographer George Balanchine counseled his dancers. Aparicio Rodriguez, a legendary shortstop in Chad Harbach's novel *The Art of Fielding*, may put it in more metaphysical terms, but "comprehending the ball and dissipating the self" expresses the essence of Beilock's research.

In nerve-racking circumstances, the most successful practitioners of any complex physical activity lose themselves. Think of Michael Jordan shrugging in disbelief after his sixth three-pointer in the first half of a 1992 NBA Finals game. If you don't lose yourself, if pressure heightens your consciousness of what's at stake and who's watching to the point that you exert conscious control over ingrained techniques, you lose.

University of Maryland sports scientist Brady Hatfield has shown that, during the relaxed execution of a practiced skill, communication between the motor and reasoning areas of the brain decreases. A beginner's brain, on the other hand, is abuzz with motor and reasoning cross talk, trying to translate newfound knowledge into action. When anxiety increases, experts can start to think like novices, and their performances suffer. "Too much brain interference with movement," Beilock writes, "can make you choke."

That explains a lot. Like how the state-finals stakes and home-field enthusiasm stirred up so much motor and reasoning static when a routine ground ball came rolling toward me with two outs in the bottom of the last inning.

Heimlich maneuvers

In her book *Choke*, Sian Beilock offers tips to prevent choking in academics and business.

1.

REAFFIRM YOUR SELF-WORTH.

Before a big test or presentation, spend a couple of minutes writing about your many interests and activities to promote feelings of self-worth and boost your confidence and performance.

2.

MAP OUT YOUR COMPLEXITIES.

Before taking an important test, spend five minutes drawing a diagram of everything that makes you a multifaceted individual to highlight that this one test score doesn't define you.

WHAT MAKES SIAN BEILOCK CHOKE? PARALLEL PARKING WHEN HER HUSBAND IS IN THE CAR.

PHOTO BY JASON SMITH

Beilock distinguishes the phenomenon known as choking from simple poor performance. Choking occurs when anxiety causes people to perform at less than their best, when the pressure literally gets into their heads.

It's most obvious in sports and music, where prowess stored in the procedural memory splinters while a crowd watches. Golfer Greg Norman became a symbol of pressure-induced meltdowns in the 1980s and '90s, losing several major tournaments after building big leads. Singer Jessica Simpson, in a 2006 Kennedy Center tribute to her idol Dolly Parton, cut short her rendition of "9 to 5" because she couldn't remember the words. "Dolly," she said, "you make me so nervous."

Beilock confesses to her own trouble with choking: parallel parking when her husband is in the car. "I'm very good at parallel parking when nobody's watching," she says, "but when he's in the car, it's a total choke situation." Beilock, in fact, has a personal interest in how anxiety affects performance, rooted in her own athletic and academic experiences.

Growing up in the Bay Area, she was a strong student and an accomplished athlete, good enough to play lacrosse at the University of California, San Diego, and soccer in the Olympic development program. When the stakes were highest, though, the skills she spent hours refining sometimes failed her. "I had one of the worst soccer games of my life playing in front of college recruiters," Beilock writes, "and I could never manage to score as well on the actual SAT as I did on the many practice tests." Even then, she wondered what caused her performance fluctuations: "I was always interested in trying to uncover the reasons, the why, that in certain situations, we don't perform at our best."

3.

WRITE ABOUT YOUR WORRIES.

Writing for ten minutes can thwart the anxieties and self-doubt of a high-pressure situation.

4.

MEDITATE AWAY THE WORRIES.

You can train your brain not to dwell on negative thoughts and instead recognize and then discard them. Meditation training can help to harness all of your cognitive horsepower for the task at hand.

5.

THINK DIFFERENTLY.

Think about yourself in ways that highlight your propensity for success. Focus on your credentials to help turn a bad performance into a good one.

Since earning PhDs in both kinesiology and psychology from Michigan State, Beilock has uncovered some answers and preventive techniques. She knew one method years ago, even if she didn't understand its mental effect. Preparing for the draw to begin her college lacrosse games, she would sing a song in her head, a habit her dad instilled. "Now I realize that was an effective technique for taking my mind off something I knew how to do very well."

Those practiced actions should be on autopilot, she says, but the pressure of a recruiter's evaluation, a career-defining presentation, or even a spouse's opinion often leads to overthinking. "The prefrontal cortex, which is sort of the seat of our thinking and decision making, gets overinvolved in a way that's not good."

In other situations, autopilot won't do. Taking a math test, for example, or interviewing for a job, requires "explicit memory," what Beilock calls the "cognitive horsepower" stored in the prefrontal cortex. Instead of causing a person to think too much, worrying reduces the ability to think enough about the task at hand, and obstructs access to relevant knowledge. "We tend to fail when that cognitive horsepower goes awry," Beilock says, "when it's devoted to worrying about the situation and its consequences rather than to focusing on a test problem or answering an on-the-spot question."

Her research has shown that meditation "can train your brain not to dwell on negative thoughts." How you think about the physical reactions to stress also matters. Beilock notes that quickened heartbeats and sweaty palms occur not only because of anxiety but also because of happy emotions like love and excitement. As she puts it, if you consider butterflies a sign that you're amped up as opposed to freaking out, "you may be able to turn your body to your advantage."

WE TEND TO FAIL WHEN COGNITIVE HORSEPOWER GOES AWRY—WHEN WE'RE FOCUSED ON WORRYING, NOT THE SUBJECT AT HAND.

More tips to prevent choking in academics and business.

6.

REINTERPRET YOUR REACTIONS.

When under pressure, if you can interpret your bodily reactions in a positive way ("I am amped up for the test") rather than negative ("I am freaking out"), you may be able to turn your body to your advantage.

7.

PAUSE YOUR CHOKE.

Walking away for a few minutes from a challenging problem that demands working memory can help you to think in a new way or from an alternative perspective—and can produce an "aha" moment.

8.

EDUCATE THE WORRIES.

Drawing attention to stereotypes—for example, "Girls can't do math" or "Whites are not as good at math as Asians"—and remembering that they are only stereotypes can help prevent people from worrying about their ability.

San Francisco 49ers quarterback Joe Montana huddled with his teammates in the final minutes of the 1989 Super Bowl. Behind by three points, 92 yards from a game-winning touchdown, in front of about 75,000 people in the stadium and 81 million television viewers, Montana noticed one guy in the crowd. "Look," he said. "Isn't that John Candy?"

It was typical of Montana that, when other players might have had clammy palms and dry mouths, his mind would wander from the magnitude of the moment to a movie star in the stands. Known for leading comebacks and making clutch plays when it counted the most, he built his football reputation on preternatural calm.

Whether or not he studied sports psychology, Montana had an intuition about how pressure affects performance, and he mentioned John Candy in the huddle for just that reason. He thought that his teammates, including an especially anxious offensive tackle named Harris Barton, were too tense. So Montana offered a diversion from the pressure. "Everybody kind of smiled, and even Harris relaxed," Montana said in his 1995 autobiography written with Dick Schaap, "and then we all concentrated on the job we had to do," driving down the field and scoring the game-winning touchdown with 34 seconds to play.

It's not that Montana was less aware of the pressure than his teammate Barton; it just affected him differently. And, perhaps unwittingly, Montana used a technique that Beilock has shown to help overcome sports performance anxiety: "Distract yourself. Singing a song or even thinking about your pinky toe as Jack Nicklaus was rumored to do can help prevent the prefrontal cortex from regulating too closely movements that should run outside awareness."

As Montana implied when he said the distraction allowed the 49ers to concentrate on their jobs, John Candy's presence did not erase conscious awareness of the work to do. Taking their minds off the pressure, though, might have allowed them to follow another Beilock mantra: "focus on the outcome, not the mechanics." An accomplished free-throw shooter, for example, might lapse into thinking about the minutiae of form to numb the nerves in a pressure situation. Robin Jackson, a sports scientist at Brunel University in London, has proven why that's a bad idea.

Jackson had soccer players of equal skill levels set objectives before dribbling a ball through cones. The players who chose technique-oriented goals ("Keep loose with knees bent") fared worse than those with a strategic focus ("Keep the ball close to the cones"). In fact, Beilock writes, "technique focus results in worse performance than if they paid no attention to detail in the first place." Under duress at the free-throw line, then, a player who becomes aware of the anatomical Rube Goldberg machine at work loses the subconscious benefits of practice. Better for the shooter to envision where the ball will land in the net, Beilock says, triggering motor cues in the brain from successful repetition.

Reaction to pressure is a matter of interpretation. At the University's Human Performance Laboratory, which Beilock runs, researchers evaluated undergraduate math test results based on levels of the stress hormone cortisol. For some students, higher levels of the hormone meant lower test scores. But others' scores rose as their cortisol increased. It turned out that the students whose higher cortisol correlated to lower scores had previously reported math anxiety. Those whose results

9.

THE OBAMA EFFECT.

Seeing examples of people who defy common stereotypes about sex, race, and ability can help to boost the performance of people in these social groups.

10.

PRACTICE UNDER PRESSURE.

Study under the same conditions you will be tested under—for instance, in a timed situation with no study aids—to get used to what you will experience on test day.

11.

OUTSOURCE YOUR COGNITIVE LOAD.

Write down the intermediate steps of a problem rather than trying to hold everything in your head. This provides an external memory source and you may be less likely to mix up information or forget important details.

improved as the stress hormone increased had no such fear.

Everybody felt the test pressure, as their hormonal reactions proved, but responses to the stress varied depending on preexisting feelings about the subject. Some people treat anxiety as a signal to perform at their best. Others dwell on it as a sign of impending failure.

It's possible to neutralize ominous ruminations, if not eliminate them. Writing about worries before taking an exam dilutes their negative impact on students with test anxiety, Beilock says, "in essence downloading them from mind so they're less likely to pop up in the moment and distract them." In a paper published in the January 14 *Science*, Beilock and Chicago PhD student **Gerardo Ramirez** reported the effect. Test-anxious ninth graders who spent ten minutes writing about their feelings before a biology exam earned a B-plus on the test, compared to a B-minus for those who didn't write, a significant difference between students with otherwise comparable academic credentials. "We show that this has an especially big effect," Beilock adds, "for students who are high in test anxiety."

In October she published research in the journal *Cerebral Cortex* identifying the brain activity of math-anxious students who overcome their fears to succeed on tests. Students whose fMRI scans revealed an activation of the region that regulates negative reactions fared twice as well on exams as those whose brains did not respond in that way. That activation sparks a series of mental responses that help students block out their anxiety and focus on how to solve the test problems. One way to trigger that brain response, Beilock says, is to talk through the solutions out loud, which trains attention on the mathematical techniques and off of the tension.

Some techniques to repel pressure work whether the activity draws on procedural or explicit memory. One of the most effective, Beilock says, is to practice under stress. The prepping doesn't have to be as intense as the real-life pressure situation itself, which is almost impossible to simulate, but it should be enough to acclimate your mind to performing under those conditions. Timed SAT practice tests, for example, or free throws that determine whether or not teammates run sprints, Beilock says, help people "get used to the pressure they're going to feel in the actual do-or-die situation."

How early in life a person learns a skill can also influence performance under pressure. Beilock and University of Houston psychologist Arturo Hernandez have shown that golfers who learned to play after age ten, even after years of practice, put more conscious thought into their actions. "The people who learned to play earlier tended to be less likely to start unpacking their performance and thinking about the detail," Beilock says. "We think that's because they learned to play when they weren't overanalyzing every step."

Younger kids are less likely to overanalyze because the prefrontal cortex doesn't fully develop until adulthood. For them golf becomes, in effect, a native language acquired with the sensory and motor areas of the brain. Skilled players who learn later are more like an older person encountering a foreign language; even if they become fluent, they lack the intuitive command of someone who learned it earlier in life. Because of age differences in how the brain processes certain skills, Beilock notes, "we also think that the later golfers learn, the more vulnerable they are to choking under pressure."

Beilock's tips to prevent sports and performance choking.

1.

DISTRACT YOURSELF.

Singing a song or even thinking about your pinky toe as Jack Nicklaus was rumored to do can help prevent the prefrontal cortex from regulating movements that should run outside awareness.

2.

DON'T SLOW DOWN.

Don't give yourself too much time to think and to control your highly practiced putt, free throw, or penalty kick. Just do it.

3.

FOCUS ON THE OUTCOME, NOT THE MECHANICS.

Focusing on the goal, where the ball will land in the net, helps cue your practiced motor programs to run flawlessly.

AS ANYONE WHO HAS EVER CHOKED KNOWS, THESE TYPES OF FLUBS CAN HAUNT YOU.

I was vulnerable at a young age. Despite four or five years of baseball experience, my 12-year-old mind became hyperaware at the state finals. We had already lost once in the double-elimination tournament, but with a one-run lead and two outs in the last inning, we were on the verge of taking another step toward the title. I just hoped nobody would hit the ball toward me.

There was a runner on first base when a ground ball came up the middle, rolling slowly toward second base. All I had to do was pick it up and step on second for a force out that would end the game. It couldn't have been an easier play; I didn't even have to make a throw. Pick up the ball, step on the base, game over.

I needed George Balanchine or Aparicio Rodriguez—or Sian Beilock—whispering in my ear, someone to take my mind off the fact that this easy play was weighed down with significance for me, my teammates, and the parents and friends in the crowd. My arms and legs were leaden, every movement heavy and forced, as if the communication between my synapses and muscles had short-circuited. In fact, the communication had increased, much to the detriment of me and my team.

I shifted to my right, into position to field the ball. If anything, I got there too soon, just as it skipped over the pitcher's mound. I reminded myself to put my glove in the dirt and watch the ball all the way into it, coaching commandments that were rote actions by then. Now, I realize, that mindfulness contributed to my failure to execute basic fundamentals at the most important time.

Stiff-legged, I didn't get my glove down, and the ball scooted through my legs. I don't remember much about what happened after that, but I know the other team scored two runs to win and eliminate us from the state tournament.

It still stings. "As anyone who has ever choked knows, these types of flubs can haunt you," Beilock writes, infecting the mind and developing into self-fulfilling prophecies. Professional second baseman Chuck Knoblauch went through an ordeal when he could not make an accurate throw to first. Catchers have suddenly lost the ability to toss the ball back to the pitcher. On the greens, accomplished golfers get the "yips," an actual condition that the Mayo Sports Medicine Center has divided into two types.

A certain amount of innate mental wiring creates a predisposition to succeed or fail under pressure. Chronic worriers, for example, are "more prone to buckle," Beilock says. But psychological temperament determines only so much. To a large extent, she says, "how you perform in these stressful situations is based on how well prepared you are and the tools you bring to the table to counteract it."

Now she tells me. ◆

4.

FIND A KEY WORD.

A one-word mantra (such as *smooth* during a golf stroke) can keep you focused on the end result rather than the step-by-step processes of performance.

5.

FOCUS ON THE POSITIVE.

Focusing on the negative can make you feel out of control and increase the likelihood that you will not work as hard to obtain future goals.

6.

CURE THE YIPS BY CHANGING UP YOUR GRIP.

Altering your performance technique reprograms the circuits you need to execute your shot, hopefully clearing your brain and body of the motor hiccup.